

May 2, 2005

Ms. Kimberly Tisa
EPA New England, Region 1
1 Congress Street
Suite 1100 (CPT)
Boston, MA 02114-2023

Re: McCoy Field Site
225 Hathaway Boulevard
New Bedford, MA 02740

Dear Ms. Tisa:

This letter addresses review comments presented in the Versar, Inc. Memorandum dated April 14, 2005 from Diane Sinkowski to Laura Casey, attached to your letter to the City of New Bedford dated April 19, 2005. The review comments are related to the *Risk-Based Cleanup Request, Rev. 0, March 21, 2005*, for the new Keith Middle School Site at the above-referenced location, submitted by BETA Group, Inc. on behalf of the City of New Bedford.

The purpose of this letter is to respond to Ms. Sinkowski's comments, with focus on the adequacy of the human health risk assessment for the new Keith Middle School Site.

Comment #1 – Related to Exposure Scenarios and Pathways

The May 17, 2004 Memorandum calculated a risk-based air particle concentration (RBAC) for PCBs in support of the clean corridor excavation that was completed over the past year. This value was used to evaluate the results of dust monitoring conducted during excavation activities. This task was performed separately from the Risk-Based Cleanup Request (RBCR) risk characterization.

Clean corridor excavation activities were performed by OSHA-trained remediation workers who were subject to a Site-Specific Health and Safety Plan (HASP), in which remediation workers were required to wear dermal protection and avoid soil ingestion. Dust suppression measures were also employed throughout construction. Through the HASP requirements, soil dermal contact and ingestion were controlled. The remaining pathway by which remediation workers could be exposed was through inhalation of soil particles and subsequent ingestion of a portion of inhaled particles, as assessed using the Massachusetts Department of Environmental Protection (MADEP) approach. This approach, based on an average PCB soil concentration of 46.6 mg/kg from data available at that time and a total 1×10^{-6} risk level, resulted in a maximum acceptable air particle concentration of $\sim 400 \mu\text{g}/\text{m}^3$. As shown on Table 1, the average air particle concentration measured during the clean corridor work (measured between June 2004 and January 2005) was $46 \mu\text{g}/\text{m}^3$. Please note that this measurement was total, not respirable, air particles; therefore, it overestimates the exposure concentration of PCBs on respirable particles.

All impacted soil remaining at the Site has or will be covered by geotextile fabric prior to non-remediation workers completing the school building, so there will be no exposure to construction workers constructing the school. After completion of the school, the activity and use limitation (AUL) placed on the Site will prohibit future non-remediation construction workers from contacting impacted soil underneath the exposure management barriers without Licensed Site Professional oversight and adherence to an appropriate HASP.

Comment #2 – Related to Dermal Contact and Direct Ingestion Soil Pathways for Construction Workers

As indicated above, the RBACs were derived for evaluating dust monitoring results during clean corridor excavation that was performed by OSHA-trained remediation workers subject to a site-specific HASP that required dermal protection. Direct soil ingestion is assumed to be incomplete.

Comment #3(a) – Related to Formulas and Accuracy of RBAC Calculations

Given the HASP controls, the referenced EPA approach (EPA 2002) would consider only the particle inhalation pathway. Applying this approach (modified to include an exposure time parameter of 8 hours per day to account for partial day exposure of the remediation workers), a maximum acceptable air particle concentration of $165 \mu\text{g}/\text{m}^3$ is derived (Table 2). This value is slightly lower than that derived by the MADEP approach due to MADEP's apportioning of some particles to the ingestion route. Nonetheless, the average air particle concentration (total, not respirable) measured during the clean corridor work ($46 \mu\text{g}/\text{m}^3$) is well below this value.

Comment #3(b) – Related to Use of Relative Absorption Factors (RAFs)

Application of EPA's approach in Table 1 does not use an RAF. Because of HASP provisions, the direct soil ingestion pathway for remediation workers is assumed to be incomplete.

Comment #3(c) – Related to Henry's Law Constant for Aroclor 1245 and Evaluation of PCBs for Indoor Air Intrusion

The commenter is correct that the value presented is the Henry's Law Constant in units of $\text{atm}\cdot\text{m}^3/\text{mol}$ rather than the dimensionless value, which was the original intent. The referenced table has been corrected.

Soil vapor intrusion was assessed for constituents detected in soil gas. Soil gas was not analyzed for PCBs, so there were no data with which to assess potential PCB volatilization. Using a comparable approach to that used to estimate indoor air concentrations from soil gas, an indoor air concentration of PCBs volatilizing from subsurface soil was predicted in the school, assuming the absence of a vapor barrier (such a barrier will underlie the school). These exposure and risk calculations are presented on Tables 3-1 through 3-5. The calculations used the same exposure and modeling assumptions applied to the soil gas assessment (where used by the model), and applied the maximum concentration of PCBs detected in soil remaining on the Site ($94.5 \text{ mg}/\text{kg}$). For an 8-hour-per day, 250-day-per-year, 25-year exposure, a hazard index (HI) of 0.003 and an

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excess lifetime cancer risk (ELCR) of 1.5×10^{-7} are calculated. Added to the HI and ELCR calculated for soil gas constituents (0.017 and 5.8×10^{-7} , respectively, when expanded), a total HI of 0.02 and a total ELCR of 7×10^{-7} are calculated. These hazard and risk levels are below maximum acceptable levels established by both U.S. EPA and MADEP.

We trust that our responses adequately address the questions and concerns raised during Versar's and EPA's review of the human health risk assessment; however, we will be available to address any further questions or concerns that may arise.

Please call either of the undersigned with any questions related to the contents of this letter or any further concerns that may arise.

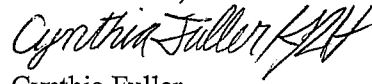
Very truly yours,

BETA GROUP, INC.



Alan D. Hanscom, P.E., LSP
Associate

ESS GROUP, INC.



Cynthia Fuller
Health Risk Assessor

Cc: Gerard Martin, MADEP
Scott Alfonse, City of New Bedford
Jacqueline Coucci, City of New Bedford
William DoCarmo, City Project Manager
Larry Oliveira, School Department
Evan Warner, Mount Vernon Group Architects
Jackie Huggins, BETA

TABLE 1
SUMMARY OF AVERAGE DAILY DUST MEASUREMENTS
Former McCoy Field
New Bedford, Massachusetts

Monitoring Date	Daily Average Dust Concentration (mg/m ³)
06/14/04	0.009
06/15/04	0.028
06/18/04	0.108
06/23/04	0.015
06/24/04	0.015
06/25/04	0.003
06/28/04	0.007
06/29/04	0.013
06/30/04	0.022
07/01/04	0.030
07/02/04	0.043
07/06/04	0.022
07/07/04	0.024
07/08/04	0.010
07/09/04	0.024
07/10/04	0.015
07/12/04	0.160
07/13/04	0.005
07/14/04	0.003
07/15/04	0.027
07/16/04	0.043
07/17/04	0.019
07/19/04	0.015
07/20/04	0.058
07/21/04	0.018
07/22/04	0.083
07/23/04	0.061
07/26/04	0.027
07/27/04	0.016
07/28/04	0.002
07/29/04	0.034
07/30/04	0.086
08/02/04	0.039
08/03/04	0.076
08/04/04	1.849
08/06/04	0.047
08/07/04	0.026
08/09/04	0.018
08/10/04	0.100
08/30/04	0.042
09/01/04	0.016
09/02/04	0.010
09/03/04	0.012
09/07/04	0.077
09/08/04	0.081
09/09/04	0.043
09/10/04	0.049
09/13/04	0.043
09/14/04	0.125
09/15/04	0.039
09/16/04	0.067
09/17/04	0.071
09/20/04	0.007
09/21/04	0.007
09/22/04	0.021
09/23/04	0.028
09/24/04	0.019
09/27/04	0.066
09/28/04	0.080
10/01/04	0.028
10/04/04	0.045
10/05/04	0.036
10/06/04	0.011

TABLE 1
SUMMARY OF AVERAGE DAILY DUST MEASUREMENTS
Former McCoy Field
New Bedford, Massachusetts

Monitoring Date	Daily Average Dust Concentration (mg/m ³)
10/07/04	0.014
10/08/04	0.036
10/09/04	0.009
10/12/04	0.025
10/13/04	0.018
10/15/04	0.032
10/16/04	0.008
10/18/04	0.006
10/19/04	0.018
10/21/04	0.019
10/27/04	0.058
10/28/04	0.007
10/30/04	0.003
11/01/04	0.014
11/02/04	0.020
11/03/04	0.050
11/04/04	0.010
11/05/04	0.003
11/08/04	0.015
11/09/04	0.118
11/10/04	0.051
11/12/04	0.017
11/15/04	0.041
11/16/04	0.010
11/17/04	0.024
11/18/04	0.037
11/19/04	0.022
11/20/04	0.029
11/22/04	0.024
11/24/04	0.018
11/27/04	0.014
11/29/04	0.010
11/30/04	0.014
12/02/04	0.007
12/03/04	0.037
12/04/04	0.006
12/06/04	0.009
12/08/04	0.012
12/09/04	0.008
12/13/04	0.042
12/13/04	0.042
12/14/04	0.006
12/15/04	0.018
12/16/04	0.008
12/17/04	0.006
12/18/04	0.013
12/20/04	0.025
12/21/04	0.027
12/22/04	0.022
12/28/04	0.014
01/03/05	0.030
01/04/05	0.001
01/05/05	0.021
01/07/05	0.022
01/10/05	0.062
Arithmetic Mean	0.046
Median	0.022

Data compiled from BETA's daily log sheet

TABLE 2
CALCULATION OF ALTERNATE AIR DUST CONCENTRATION
Former McCoy Field
New Bedford, Massachusetts

For carcinogens:

$$SSL = \frac{TR \cdot AT \cdot CF}{UR \cdot EF \cdot ED \cdot \frac{1}{PEF}}$$

U.S. EPA (2002). *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*. OSWER 9355.4-24.

Rearranging, substituting C_{soil} for SSL, adding exposure time (ET), and calculating for PEF:

$$PEF = \frac{C_{soil} \cdot UR \cdot ET \cdot EF \cdot ED}{TR \cdot AT \cdot CF}$$

Where:

SSL = Soil screening level (mg/kg)
 PEF = Particle emission factor (m^3/kg)
 C_{soil} = Soil concentration (mg/kg)
 TR = Target excess lifetime cancer risk (unitless)
 AT = Averaging time (yr)
 CF = Unit conversion factor (hr/yr)
 UR = Unit risk value [$(mg/m^3)^{-1}$]
 ET = Exposure time (hr/dy)
 EF = Exposure frequency (dy/yr)
 ED = Exposure duration (yr)

and:

$$C_{air} = 1/(PEF) \times CF1$$

where:

C_{air} = Air particle concentration (mg/m^3)
 CF1 = Unit conversion factor (mg/kg)

C_{soil} (mg/kg)	UR [(mg/m ³) ⁻¹]	ET (hr/dy)	EF (dy/yr)	ED (yr)	TR (unitless)	AT (yr)	CF (hr/yr)	PEF (m ³ /kg)	CF1 (mg/kg)	C_{air} (mg/m ³)
46.6	0.57	8	250	1	1.00E-06	1	8,760	6.06E+06	1.00E+06	0.165

TABLE 3-1
RISK CHARACTERIZATION
INDOOR INHALATION OF PCBs VOLATILIZED FROM SOIL
Future Keith Middle School
New Bedford, Massachusetts

Equation $C_{air} = [C_{soil} \times VF_{seep}]$

where:

C_{air} = Constituent concentration in indoor air (mg/m³)

C_{soil} = Constituent concentration in subsurface soil (mg/kg)

VF_{seep} = Volatilization Factor, subsurface soil to enclosed spaces [(mg/m³)/(mg/kg)]

where:

$ADE = [C_{air} \times EF \times ED \times EP \times CF] / AP$

ADE = Average daily exposure (mg/m³) (nc = non-carcinogen; ca = carcinogen)

EF = Exposure frequency (events/yr)

ED = Exposure duration (hr/event)

EP = Exposure period (yr)

CF = Unit conversion factor (yr/hr)

AP = Averaging period (yr)

$HQ = ADE / RfC$

$HI = \text{Sum} [HQ]$

$Risk = ADE \times UR$

HQ = Non-carcinogenic hazard quotient (unitless)

HI = Total hazard index (unitless)

RfC = Reference concentration (mg/m³)

$Risk$ = Excess lifetime cancer risk (unitless)

UR = Unit risk value [(mg/m³)⁻¹]

Constituent	C_{soil} (mg/kg)	VF_{seep}^{-1} [(mg/m ³)/(mg/kg)]	C_{air} (mg/m ³)	EF (events/yr)	ED (hr/event)	EP (yr)	CF (yr/hr)	AP (nc) (yr)	ADE (nc) (mg/m ³)	RfC (mg/m ³)	HQ (unitless)	AP (ca) (yr)	ADE (ca) (mg/m ³)	UR [(mg/m ³) ⁻¹]	Risk (unitless)
Aroclor 1254	94.5	9.98E-09	9.44E-07	250	8	25	1.14E-04	25	2.15E-07	7.00E-05	0.003	70	7.69E-08	2	1.5E-07

1. Supporting equations are presented on following spreadsheets.

TABLE 3-2
CALCULATION OF VOLATILIZATION FACTOR
SUBSURFACE SOIL TO INDOOR AIR
Future Keith Middle School
New Bedford, Massachusetts

$$VF_{\text{seep}} = \frac{\left[\frac{H \cdot p_s}{\theta_{ws} + (k_s \cdot p_s) + (H \cdot \theta_{as})} \right] \left[\frac{(D_{\text{eff}}^s / L_s)}{ER \cdot L_B} \right]}{1 + \left[\frac{(D_{\text{eff}}^s / L_s)}{ER \cdot L_B} \right] + \left[\frac{(D_{\text{eff}}^s / L_s)}{(D_{\text{eff}}^{\text{crack}} / L_{\text{crack}}) \cdot \eta} \right]} \cdot 10^3 \text{ cm}^3 - \text{kg} / \text{m}^3 - \text{g}$$

ASTM (1995) Standard Guide for Risk-based Corrective Action Applied at Petroleum Release Sites. E-1739-95.

where:

- VF_{seep} = Volatilization Factor, subsurface soil to enclosed spaces [(mg/m³)/(mg/kg)]
 H = Henry's Law Constant (cm³/cm³)
 p_s = Bulk soil density (g/cm³)
 θ_{ws} = Water content in vadose zone soil (cm³/cm³)
 k_s = Soil sorption coefficient (g/cm³) (= $k_{oc} \times f_{oc}$)
 k_{oc} = Organic carbon/water partition coefficient (cm³/g)
 f_{oc} = Fraction of soil organic carbon (g/g)
 θ_{as} = Air content in vadose zone soil (cm³/cm³)
 D_{eff}^s = Effective diffusivity in vadose zone soil (cm²/s)
 L_s = Depth to subsurface soil sources (cm)
 ER = Enclosed space air exchange rate (sec⁻¹)
 L_B = Enclosed space volume/infiltration ratio (cm)
 $D_{\text{eff}}^{\text{crack}}$ = Effective diffusivity through soil-filled foundation cracks (cm²/s)
 L_{crack} = Foundation thickness (cm)
 η = Areal fraction of cracks in foundation (cm²/cm²)
 CF = Unit conversion factor [(cm²-kg)/(m³-g)]

Constituent	H (cm ³ /cm ³)	p_s (g/cm ³)	θ_{ws} (cm ³ /cm ³)	k_{oc} (cm ³ /g)	f_{oc} (g/g)	θ_{as} (cm ³ /cm ³)	D_{eff}^s (cm ² /s)	L_s (cm)	ER (s ⁻¹)	L_B (cm)	$D_{\text{eff}}^{\text{crack}}$ (cm ² /s)	L_{crack} (cm)	η (cm ² /cm ²)	CF [(cm ² -kg)/(m ³ -g)]	VF_{seep} [(mg/m ³)/(mg/kg)]
Aroclor 1254	1.55E-01	1.62	0.103	9.98E+05	0.006	0.284	1.77E-03	91	0.000125	488	1.77E-03	15	0.0002	1000	9.98E-09

TABLE 3-3
CALCULATION OF EFFECTIVE DIFFUSIVITY FACTORS
Future Keith Middle School
New Bedford, Massachusetts

Effective diffusivity through soil-filled foundation cracks

$$D_{crack}^{eff} = D_{air} \cdot \left(\frac{\theta_{air}^{3.33}}{\theta_T^2} + D_{wat} \cdot \left(\frac{1}{H} \right) \cdot \left(\frac{\theta_{wcrack}}{\theta_T^2} \right) \right)$$

ASTM (1995) Standard Guide for Risk-based Corrective Action Applied at Petroleum Release Sites. E-1739-95.

where:

- D_{crack}^{eff} = Effective diffusivity through soil-filled foundation cracks (cm^2/s)
- D_{air} = Diffusion coefficient in air (cm^2/s)
- D_{wat} = Diffusion coefficient in water (cm^2/s)
- H = Henry's Law Constant (cm^3/cm^3)
- θ_{air} = Air content in soil-filled foundation cracks (cm^3/cm^3)
- θ_{wcrack} = Water content in soil-filled foundation cracks (cm^3/cm^3)
- θ_T = Total soil porosity (cm^3/cm^3)

Constituent	D_{air} (cm^2/s)	D_{wat} (cm^2/s)	θ_{air} (cm^3/cm^3)	θ_{wcrack} (cm^3/cm^3)	θ_T (cm^3/cm^3)	H (cm^3/cm^3)	D_{crack}^{eff} (cm^2/s)
Aroclor 1254	1.75E-02	8.00E-06	0.284	0.103	0.387	1.55E-01	1.77E-03

Effective diffusivity through vadose zone soil

$$D_s^{eff} = D_{air} \cdot \left(\frac{\theta_{as}^{3.33}}{\theta_T^2} + D_{wat} \cdot \left(\frac{1}{H} \right) \cdot \left(\frac{\theta_{ws}}{\theta_T^2} \right) \right)$$

ASTM (1995) Standard Guide for Risk-based Corrective Action Applied at Petroleum Release Sites. E-1739-95.

where:

- D_s^{eff} = Effective diffusivity through vadose zone soil (cm^2/s)
- D_{air} = Diffusion coefficient in air (cm^2/s)
- D_{wat} = Diffusion coefficient in water (cm^2/s)
- H = Henry's Law Constant (cm^3/cm^3)
- θ_{as} = Air content in vadose zone soil (cm^3/cm^3)
- θ_{ws} = Water content in vadose zone soil (cm^3/cm^3)
- θ_T = Total soil porosity (cm^3/cm^3)

Constituent	D_{air} (cm^2/s)	D_{wat} (cm^2/s)	θ_{as} (cm^3/cm^3)	θ_{ws} (cm^3/cm^3)	θ_T (cm^3/cm^3)	H (cm^3/cm^3)	D_s^{eff} (cm^2/s)
Aroclor 1254	1.75E-02	8.00E-06	0.284	0.103	0.387	1.55E-01	1.77E-03

TABLE 3-4
SUMMARY OF CHEMICAL-SPECIFIC INPUT VARIABLES
 Future Keith Middle School
 New Bedford, Massachusetts

Constituent	Soil Exposure Point Concentration ¹ C_s (mg/kg)	Organic Carbon/Water Partition Coefficient ² K_{oc} (cm ³ /g)	Diffusion Coefficient in Air ³ D_{air} (cm ² /s)	Diffusion Coefficient in Water ³ D_{wat} (cm ² /s)	Henry's Law Constant ² H (cm ³ /cm ³)
Aroclor 1254	94.5	998,000	1.75E-02	8.00E-06	1.55E-01

1. Maximum concentration detected in soil remaining on the Site.
2. U.S. EPA (1998). Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Peer Review Draft. EPA-530-D-98-001A, July.
3. U.S. EPA (1994). ChemDat8 User's Guide. EPA-453/C-94-080B, November.

TABLE 3-5
SUMMARY OF SITE INPUT VARIABLES
 Future Keith Middle School
 New Bedford, Massachusetts

Notation	Parameter	Value	Units	Reference
θ_T	Total soil porosity	0.387	cm^3/cm^3	Value for sandy loam (U.S. EPA 2003).
ρ_s	Dry bulk soil density	1.62	g/cm^3	Value for sandy loam (U.S. EPA 2003).
f_{oc}	Organic carbon content of soil	0.006	g/g	Assumed value, based on range cited in U.S. EPA (2003).
θ_{ws}	Volumetric water content in vadose zone soils	0.103	cm^3/cm^3	Average value for sandy loam (U.S. EPA 2003).
θ_{as}	Volumetric air content in vadose zone soils	0.284	cm^3/cm^3	$\theta_T - \theta_{ws}$.
θ_{wcrack}	Volumetric water content in soil-filled foundation cracks	0.103	cm^3/cm^3	Same as θ_{ws} .
θ_{acrack}	Volumetric air content in soil-filled foundation cracks	0.284	cm^3/cm^3	Same as θ_{as} .
L_s	Depth to subsurface soil sources	91	cm	3 Feet; planned thickness of clean cover over fill.
ER	Building air exchange rate	0.000125	s^{-1}	0.45 air changes per hour, MADEP (2004).
L_B	Enclosed space volume/infiltration area ratio	488	cm	MADEP (2004).
L_{crack}	Enclosed space foundation thickness	15	cm	MADEP (2004).
η	Areal fraction of cracks in foundation	0.0002	cm^2/cm^2	U.S. EPA (2003).

MADEP (2004). Proposed revised Method 1 Numerical Standards and supporting documentation. September.

U.S. EPA (2003). Users Guide for Evaluating Subsurface Vapor Intrusion Into Buildings. June.